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Evaluation of prothrombin time, activated partial thromboplastin time, and D-dimer among Sudanese patients with hypertension

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Abstract

Aim: Hypertension is typically described as a prolonged rise of systemic arterial pressure above an expected average value. Significant coagulation variations have been documented in hypertension patients. This study aims to evaluate prothrombin time, activated partial thromboplastin time, and D-Dimer levels in hypertensive patients.

Material and Methods: This case-control study was conducted between March and June 2020 at Al-Daw Hagoug Hospital and Al-Turkey Hospital in Khartoum State, Sudan. The study included 90 participants: 50 patients with hypertension (blood pressure over the normal range) as the case group and 40 healthy people as the control group. After participant consent, Pt and APTT tests were performed using the (Bio base COA Semi Auto Coagulation Analyzer, Jinan, Shandong, China), and the D. Dimer test was performed using the (Nyco-Card Reader II device).

Results: The most common disease duration category was 1 to 10 years. Compared to the control group, hypertension patients showed a significant (P=0.034) increase in PT and an insignificant (P=0.130) change in APTT. The results show a significant difference in PT (P=0.029) between the HTN and HTN combined Diabetes Mellitus (DM) groups. D-dimer levels were significantly higher (P=0.005) in hypertension patients than in the control group.

Discussion: The study assumed that hypertension had an adverse influence on hemostatic parameters and could lead to a hypercoagulable state.

Keywords

Hypertension, Coagulopathy, Sudan

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Introduction

Hypertension (HTN) is a chronic disease characterized by an elevation in systemic blood pressure above standard level [1]. The most prevalent causes are regarded to be family history, alcohol consumption, obesity, smoking, and lifestyle, particularly in low- and middle-income nations [2, 3], where one in every three people realizes their hypertension condition and only about 8% have their blood pressure under control [4]. Despite existing data and considerable clinical and experimental research, the origin of hypertension remains unclear in around 95% of all cases [5]. Hypertension is a widespread condition that affects roughly 116 million individuals in the United States and over 1 billion adults globally: according to Romano's (2023) study, hypertension shapes about 19.06% of the population [6, 7]. Sudan has a hypertension prevalence of 27.6% [8]. Hypercoagulable state, cardiovascular disease, cerebellar disease, renal disease, and a range of other health conditions are significantly more common in hypertensive persons. [9, 10]. Hypertension can be classified as either secondary or primary. This is mainly because no medical explanation for elevated blood pressure can be defined. This kind accounts for 90% to 95% of hypertension events [11, 12]. Accurately estimating blood pressure in the right environment under the ideal circumstances is required to diagnose hypertension. The patient must sit in a chair for at least 5 minutes with their arms resting. Two measures of high blood pressure on two separate dates are required to establish a diagnosis [13]. The environment, arm posture, body components, variation in arm mass, and clinical measurement settings all influence blood pressure; all persons over 40 should get their blood pressure checked once a year. [14]. Coagulation activation mechanisms, according to previous research, start in hypertensive individuals even before clinical symptoms of vascular damage develop and are regarded as one of the main pathophysiological pathways of hypertension [15, 16]. In hypertensive and normotensive individuals, Prothrombin Time (PT) and Activated Partial Thromboplastin Time (APTT) are related to higher systolic and diastolic blood pressures [17]. Significant variations in PT and APTT were reported between hypertensive and normotensive patients in research that included 111 patients with mild to moderate hypertension attending Al-Najaf Hospital in Iraq [18]. Platelet hyperactivity, other coagulation, and endothelial damage changes may all play a role in the vascular effects of essential hypertension [19]. D-dimer is the final output of fibrin breakdown by plasmin. D-dimer levels also play a crucial role in the etiology of hypertension [20, 21]. This study aims to assess prothrombin time, activated partial thromboplastin time, and D-Dimer levels in hypertensive patients.

Material and Methods

This case-control study was performed at Al-Daw Hagoug Hospital and Al-Turkey Hospital in Khartoum State, Sudan, between March and June 2020. The study enrolled 90 participants: 50 patients with hypertension (Those with blood pressures above the normal range and those whose diagnosis is frequently determined by averaging two or more readings obtained at different times) as the case group and 40 healthy individuals as the control group. The data was gathered from the participants using a standardized questionnaire. Patients with a history of thrombosis or who are taking warfarin or heparin were excluded from the research study. Five ml of Venous blood was obtained under all sepsis settings in citrated anticoagulated containers at a ratio of (4.5 ml to 0.5 ml of citrate anticoagulant) for obtaining platelet-poor plasma samples. All citrated samples were centrifuged at 5000 rpm for 5 minutes to perform the Pt and APTT tests by using the (Bio base COA Semi Auto Coagulation Analyzer, Jinan, Shandong, China) and the D. Dimer test using (Nyco-Card Reader II device).

Statistical analysis

The collected data was coded in the master sheet before being analyzed with the computerized software SPSS version 14.0. The study's various groups were analyzed using an independent t-test and Onaway ANOVA, and the results were presented in tables and graphs. A P value of less than 0.05 was taken to be significant.

Ethical Approval

All subjects agreed to participate after being informed about the study's objectives. This study was authorized by the research panel at the Sudan University of Science and Technology's College of Medical Laboratory Science; the research was conducted under the Helsinki Declaration. This study was approved by the Ethics Committee of Sudan University of Science and Technology's College of Medical Laboratory Science (Date: 2020-02-10, No: SU/CMLS: 10220).

Results

Table 1. reveals that there are more females than males. Most

Table 1. The characteristics of the study population

Characteristic		Frequency	Percent (%)
Sample	Case	50	71.4
	Control	40	28.6
Sex	Male	Case: 13	14.4
		Control: 11	12.2
	Female	Case: 37	41.1
		Control: 29	32.2
Age	<50	64	75.7
	50-70	21	18.6
	>70	5	5.7
HTN duration	1.10	35	70.0
	11.20	9	18.9
	21-21	6	12.0
Disease	HTN	29	58
	HTN+DM	21	42
Aspirin use	Yes	35	70
	No	15	30

Table 2. The variation of (PT, APTT, and D-dimer) among case and control

Sample	Subjects	Mean		
		PT/sec	APTT/sec	D. dimer/mg/l
Case	50	14.34	31.18	0.428
Control	40	13.20	29.05	0.145

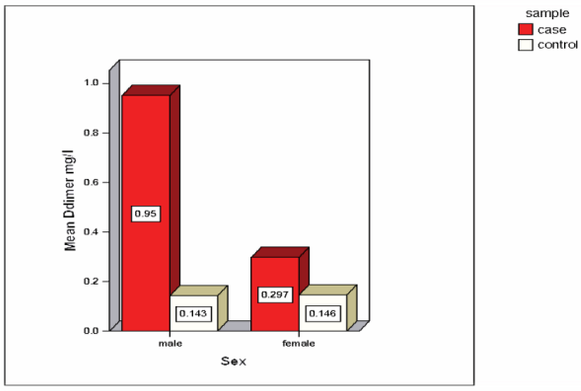

Figure 1. The variation of D-dimer according to sex among case and control

of the subjects (75.7%) are over the age of 50. The most common category for disease duration was 1 to 10 years. Table 2. demonstrated that hypertension patients had a significant (P=0.034) increase in PT and an insignificant alteration in APTT (P=0.130) compared to those in the control group. There was a statistically significant variation (P=0.045) in PT levels concerning sex; the male group had higher PT levels than the female group; nevertheless, the study found an insignificant difference (P=0.511) in APTT levels according to sex. Furthermore, the current study found significant differences in PT (P0.002) and APTT (P=0.01) values between age groups of both sexes. The study found no statistically significant differences (P=0.194) between groups regarding HTN duration. The finding indicates a significant difference in PT (P=0.029). in the HTN and HTN combined with Diabetes Mellitus (DM) groups; however, although an insignificant difference in APTT (P=0.116) was seen between disease duration groups, either HTN or HTN with DM. The present research results revealed a significant difference in PT between patients on aspirin therapy and those who did not take aspirin in both sexes (p=0.030) but an insignificant difference in APTT (P=0.719). Figure 1. demonstrates that D-dimer levels in hypertension patients were significantly higher (P=0.005) than in the control group. The research also found no statistically significant variations in D-dimer levels between men and women (P=.0187) or between patients who used aspirin and those who did not (P=0.584).

Discussion

The present study found that hypertension patients had significantly higher PT than the control group (p=0.034). There was a significant difference in PT by sex (P=0.045); the male group exhibited more PT than the female group. The study found a significant (P0.002) variation in PT between age groups (50,50-7-, and 70 years) in both sexes. No significant difference was found in the study (P=0.194) between groups based on HTN duration. There was a significant difference in PT results (P=0.029) between the HTN group and the HTN with Diabetes Mellitus group. The current research results found a significant difference (P=0.030) between patients receiving aspirin medication and those who did not. This finding contradicted a prior study by Bajaj SP et al. (1999) [22] and a study in Sudan (2007) [23] by Fathelrahahman Gameel, who found insignificant results. The contradiction may be in response to aspirin usage in our study. Our investigation showed no statistically significant difference in APTT compared to the control group (P=0.130). In addition, no significant differences were found between APTT (p=0.511) and disease duration groups (P=0.601). However, there was a significant difference in APTT between both sexes' age groups (P=0.01). There was an insignificant difference between the two groups (P=0.116) based on the disease condition, whether HTN or paired with DM. APTT also revealed a negligible difference (P=0.719) between patients who used aspirin and those who did not; this is consistent with the findings of Fathelrahahman Gameel (2007) [23] in Sudan, who discovered an insignificant difference (P=0.626). In our study, hypertension individuals had a significant rise in D-dimer compared to the control group (P=0.005). There was no significant variation in D-dimer based on gender (P=.0187). D-dimer analysis found a substantial difference in age groups for both sexes (P=0.05). In addition, no significant variation in D-dimer was identified according to HTN duration (P=0.426). Plasma D-dimer levels in the HTN group were not significantly different from those in the HTN with DM group (P=0.373). Furthermore, no significant difference in D-dimer was seen across patients who used aspirin and those who did not (P=0.584); these findings are consistent with previous studies, such as [24] those of Cristiana et al. (2000) and M. KHALEGHI in the United States (2009) [25].

Conclusion

The study concluded that hypertension had an adverse influence on hemostatic parameters and could lead to a hypercoagulable state; elevated plasma D-dimer levels in hypertensive patients may help guide the physician toward more extensive diagnostic procedures to detect and follow up on the HTN complication.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or compareable ethical standards.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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